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ROCKS and MINERALS

A Magazine for Mineralogist,
Geologist and Collector . . .

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The Rocks and Minerals Association

.. JULY, 1937 ..

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Edited and Published by
PETER ZODAC

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ROCKS and MINERALS PEEKSKILL, N. Y., U. S. A.

The Official Journal of the Rocks and Minerals Association

CHIPS FROM THE QUARRY

(Formerly the Bullettin Board)

WILLIAM NIVEN

William Niven, honorary life member of the American Museum of Natural History; titled member of the scientific society Antonio Alzate, Mexico; a fellow of the American Geographical Society and Royal Society of Arts, London; and a member of the Rocks and Minerals Association, died at his home in Austin, Texas, Wednesday, June 2, 1937, at the age of 86.

Mr. Niven was a distinguished mineralogist and archaeologist who explored vast areas, especially in Mexico, making many valuable archaeological discoveries. In 1911, his expedition was successful in finding buried prehistoric cities in the Valley of Mexico.

In the mineralogical field he likewise made many discoveries of which the most important were the finding of yttrialite, thorogummite, fergusonite and nivenite (named in his honor). A very interesting article "My Mineral Discoveries since 1879" prepared by Mr. Niven, appeared in the September, 1930 issue of *Rocks and Minerals*.

Mr. Niven was born at Bellshill, Lanarkshire, Scotland, October 6, 1850. He came to America in 1879. His death is a real loss to mineralogy and a cause of much sorrow to those who knew him personally.

Who Will Oblige?

Rocks and Minerals is desirous in obtaining a number of articles for some special quartz numbers on amethyst, geodes, jaspers, etc. We have so far a short article on an amethyst occurrence in Maine; three good articles on geodes in Iowa and Ohio; and one good article on jaspers of the Mohave Desert, California. Who can supply information on occurrences in other states or countries? An article on minerals found in geodes would be especially appreciated.

We can use articles on any type of quartz.

Lillian Fraser, and Gwynne Richards, who for many years were connected with Stephen, Varni Co., have now opened an office of their own at 165 Fifth Avenue, New York, N. Y.

They will deal in precious and semi-precious gems of all kinds, also, a few choice minerals.

They will carry fine, hand wrought jewelry, and will make a specialty of platinum, gold and silver work; designing, and the remodeling of jewelry.

Publications Received

Manual on Geophysical Prospecting with the Magnetometer. By J. Wallace Joyce, This manual on magnetic prospecting with the Schmidt-type magnetometer is one of a series being prepared by the U. S. Bureau of Mines to describe the theory, instruments, field technique, and some of the fundamental principles that underlie the interpretation of various methods of geophysical prospecting. 129 pp., 52 figs. For sale by the American Askania Corp., Houston, Texas. Price $1.50.

Guide to Trails Around Washington. By Robert Shosteck, Wanderbirds Hiking Club, 1659 Newton St., N. W., Washington, D. C., price 50c. Contains 32 trail maps and detailed descriptions of 45 hiking and camping trips—swimming places, geology, natural history and historic lore. The last chapter of the booklet is entitled "Mines, Minerals and Quarries near Washington," pp. 71-78.

Vacation Week-End and One-Day Hiking Trips, May-Oct., 1937. By Ernest A. Dench, Honokus, N. J., price 10c. 48 pp. Covers hikes in all of the northeastern states from Pennsylvania to Maine. A number of trips scheduled are to mines and quarries where minerals may be collected.

Occurrence, Properties, and Preparation of Limestone and Chalk for Whiting. By Hewitt Wilson and Kenneth C. Skinner. 160 pp., 47 figs. Issued by the U. S. Bureau of Mines as Bull. 395. For sale by the Supt. of Documents, Washington, D. C., price 30c.

A Chronological History of the Franklin Zinc District. By John Reiner. Three mimeographed sheets listing many important dates in the progress of America's greatest mineral locality—Franklin, N. J. Issued by the Newark Mineralogical Society, Newark, N. J.

Iron in Ancient Times; Iron Mining in New Jersey. By Wm. H. Broadwell. Five mimeographed sheets full of interesting information. Issued by the Newark Mineralogical Society, Newark, N. J.

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The Official Journal ROCKS and MINERALS of the ASSOCIATION

WHOLE No. 72

THE EPIDOTE LOCALITIES OF PRINCE OF WALES ISLAND, ALASKA

By ARTHUR MONTGOMERY

INTRODUCTION

For most minerals there are one or more localities which have produced exceptional crystallized specimens. That calcium-iron-aluminum silicate and common rock-forming mineral, epidote, has proved no exception to the rule, although good crystals of it are always a rarity and just two localities have thus far produced material of prominence.

The first important locality was discovered well back in the last century, in a rather inaccessible spot high up in the Untersulzbach valley of the Austrian Alps. The epidotes from here must be regarded as the finest of their kind, and indeed, by any standards of beauty and perfection, these long, slender, brilliant-black crystals have seldom met their match among the most highly-prized specimens from any world locality. But this Untersulzbach occurrence was soon exhausted, and seems never again likely to produce further material.

Around 1900 a second outstanding epidote locality came to light. Halfway around the world from the Austrian occurrence, and even more inaccessible, the locality was reported to be on Prince of Wales Island, off the southern Alaskan coast. Not much came to be known about the occurrence, but a certain C. B. Ferguson was supposed to have collected all the early specimens and the find was obviously connected with certain copper-mining activities in that section of the island. The specimens themselves, most of which were marketed by the late W. C. Hart of Manitou, Colorado, proved to be very exceptional for crystal size and habit. Where the Untersulzbach crystals had been long and slender, these were of stout, tabular, almost-square shape, with twinning striations plainly marked on the large b-face. The biggest crystals reached a size anywhere from three to five inches in two directions. Some later material, consisting of attractive groups of smaller, more brilliant crystals, also appeared on the market some years ago. These also had been collected by Ferguson.

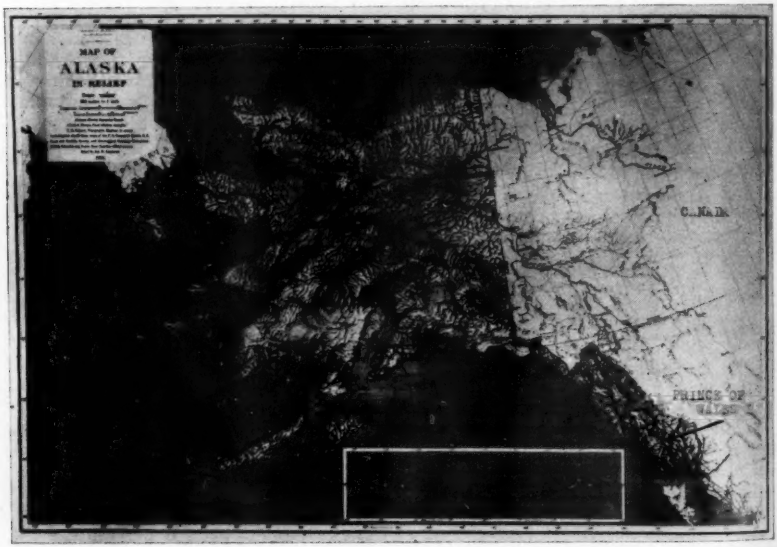
Last summer a party of four of us made the trip to Prince of Wales Island with the object of collecting further epidote and exploring for other minerals. The members of the expedition, in addition to the writer, were E. P. Henderson of the National Museum, Edwin Over, and Ferguson himself. Ferguson was most eager to return to the island, for he had lived in Seattle for some years and greatly missed his old hunting-ground. Though well over seventy, he said he felt fit for the trip and equal to leading us back into the interior mountain country where he had found his epidote.

He told us that he had made his earliest find on a mountain some miles back of Copper Mountain, the

highest peak in that area and around which most of the copper-mining activity had centered. In opening up some prospects on the upper slopes of Green Monster Mountain, Ferguson had stumbled right upon one of the world's foremost mineral occurrences. Countless years of weathering had left the epidotes, both as loose crystals and wonderful groups up to a great size, partly exposed on the surface. There they were, waiting for the first discoverer to pick them up. Ferguson claimed to have done very little work in this spot, and some thorough mining operations seemed to be in order and to promise much. In later years he had found other types of epidote, as well as various associated minerals, on Copper Mountain, but Green Monster Mountain had produced by far the finest material and appeared to be the likeliest locality to work. The whole surrounding area, with its widespread contact-metamorphism, should prove to be rich in all sorts of minerals, and no one other than Ferguson, who was not a trained mineralogist, had ever searched the region for specimen material. All of us in the party knew that there would be many difficulties, among which constant rain, plagues of flies, impenetrability of the vegetation, and wildness and inaccessibility of the country looked to be the most severe. However, these did not loom so serious in our minds when we considered entering a new, almost untouched region, where superbly-fine minerals had been proven to exist.

LOCATION OF THE AREA AND HISTORY OF MINING

The area in question, called the **Copper Mountain area,** is situated in the west-central part of Prince of Wales Island. It embraces roughly



Courtesy U. S. National Museum

RELIEF MAP OF ALASKA
Prince of Wales Island is in the Extreme Southeastern Part of Alaska. Arrow Points to Island.

about 80 square miles of dense forest and rugged mountain terrain, the mountains rising to an altitude of close to 4,000 feet in the loftiest summit, Copper Mountain. The area is bounded on the north and west by Hetta Inlet.

The area is now practically uninhabited though ruins of various settlements along the shores of the inlet indicate a considerable former population in the time of the mining activity.

The copper mining began shortly after 1900. Rich ore deposits were opened up on the west slope of Copper Mountain, in Jumbo Basin, at an altitude of 2,000 feet, and an aerial tramway was constructed to carry the ore down to the shores of the inlet. A small settlement sprang up here, generally called Jumbo Mine; a still larger one at Sulzer, further north along the inlet; and a third to the south, called Copper Harbor, where a small smelter was built and later

Courtesy U. S. National Museum

TOPOGRAPHY OF THE REGION AROUND COPPER MOUNTAIN, PRINCE OF WALES ISLAND

on a salmon cannery.

Mining production went ahead until 1918, when the mines closed down entirely. They have never been reopened. One by one, the various settlements were abandoned, and now except for a few old buildings still standing at Jumbo Mine hardly a trace is left of the former active life. One watchman still remains at Jumbo, the only living person in the entire area.

C. B. Ferguson had been connected with the mining operations since their very inception, and had remained in the area for many years, even after the mines had shut down. We knew him, and found him, to be more familiar with the region than any living person.

GEOLOGY OF THE AREA

Just a few words on the general geology, which is well covered in C. W. Wright's Geological Survey Report of 1915.* The area consists in its central high-mountain mass of an igneous batholith. This central intrusive core is surrounded on all sides by a rough circumference of highly-metamorphosed limestones and schists. Between the limestones, primarily, and the igneous rocks considerable metamorphism has taken place, with the frequent formation of sharply-defined zones of contact rock. These contact zones, hundfreds of feet in width and sometimes miles in lateral extent, are made up chiefly of a garnetiferous rock. Along with the massive garnet there are found a few typical contact minerals, such as epidote, diopside, amphibole, etc. The epidote occurs in seams and veinlets throughout the garnet matrix, and when the conditions have been favorable crystallization has taken place in open cavities. It is also along these contact zones that the copper ore deposits have formed, consisting principally of chalcopyrite with associated pyrrhotite, magnetite and molybdenite.

Our party assembled in Seattle during the middle of May, 1936. It

*Geology and Ore Deposits of Copper Mountain and Kasaan Peninsula, Alaska, by C. W. Wright, U. S. Geological Survey, Professional Paper 87, 1915.

COPPER MOUNTAIN (Snow-clad)

The Depression Between Mine Buildings in Foreground and Copper Mountain is Jumbo Basin.

seemed an early date to be starting for Prince of Wales Island, but Ferguson said that for all prospecting on the higher mountain slopes it was imperative to be on hand as soon as the snow began to melt. The grass would soon grow like wild-fire, making surface exploration almost impossible. As for any prospecting lower down, that was quite out of the question, since the vegetation everywhere had the luxuriance and denseness of a tropical jungle. The tremendous rainfall, about 170 inches per year, and a not-too-cold climate accounted for this.

We planned to remain on the island for at least three months, and we had to have provisions to last throughout our stay. This meant an intensive food-buying program in Seattle. It is not an easy matter to purchase a satisfactory food supply to last four people during three months, and it was a surprise to all of us to see how much was needed. We took along nearly a ton of provisions alone.

Suitable clothing also was a matter to occupy our minds. Everything must be waterproof, even to a special brand of half-rubber and half-leather boot. We were strongly advised to buy mosquito-nets for our heads, but Ferguson, always insisting that his old home was a veritable paradise, scoffed at the idea and said that only the rawest tenderfoot bothered with such things. Luckily for us we decided to buy the nets anyway; we had heard stories of the biting prowess of the Alaskan flies.

We took one of the Alaska-Line tourist steamers from Seattle and found ourselves in Ketchikan after a two-day run through the scenic inland passage. Unfortunately we saw little scenery, for it rained steadily and had become a downpour by the time we reached Alaska's second biggest metropolis.

Prince of Wales Island lies twenty or thirty miles west of Ketchikan. Our destination was the Jumbo Mine on Hetta Inlet, and we would have to go clear around the southern tip of the island and a long distance up the west side to get there. For the fourteen-hour trip we chartered a small gasoline boat which had difficulty finding room for all our baggage.

LOOKING DOWN ON HETTA INLET FROM ABOVE THE MINE ON COPPER MOUNTAIN

We started one cold rainy morning at 4 a. m. In several hours the weather began to clear, and we soon had sun and blue sky. This change of weather was a great stroke of luck, for in any sort of storm tremendous seas pile up around Cape Chacon, southernmost point of Prince of Wales Island, and make the trip a dangerous one for a small boat.

Several hours after rounding the cape we sighted the high snow-peak of Copper Mountain far to the north. Low clouds were soon obscuring the mountains now, and the weather took a turn for the worse. By late afternoon we were dropping anchor in Hetta Inlet, opposite the few old buildings on the shore which represented all that was left of the Jumbo Mine settlement. A tremendously high and dense forest came right down to the water's edge, and now and then, through the clouds we caught glimpses of snow high up on the steep mountain slopes which rose sheer behind the camp.

The watchman, Viv Walters, put out from the shore in his rowboat, and we were soon busily engaged transferring bags and boxes to our future camp quarters. With everything unloaded, our boat pulled anchor and was soon a mere receding speck down the still waters of the inlet.

We spent the next few days getting settled in camp and making our quarters comfortable. We were able to utilize two old buildings, still more or less intact, one suitable for a cookhouse and the other for sleeping quarters. It was very essential to have a comfortable base camp here to keep us dry and warm during bad weather. Walters told us that we would be lucky to have one whole week of dry weather all summer. And to back up what he said, there was a constant drizzle of rain those first days in camp, with low-lying clouds always hiding the mountains.

Finally we were ready to start work. Our plan of campaign was first to explore the more accessible portions of Copper Mountain, using the camp as a base, and then to penetrate into the interior and tackle Green Monster Mountain. The very trip into this back country was a problem, for although the distance was only five or six miles, it was steep, rugged terrain with all the old trails completely overgrown, and there were three sizable lakes which had to be crossed.

We found a fair trail up to the mines in Jumbo Basin, though very steep in parts and overgrown with bushes and blocked with some fallen trees. Good epidote specimens had come out of some of the mine tunnels, and we decided to prospect them first, as long as the weather stayed wet. Now and then the clouds lifted a little, and we would catch momentary glimpses of magnificent scenery all around us, lofty snow peaks above and a vast panaroma of green forest below, cut by the silvery ribbon of Hetta Inlet.

Our work in the mine tunnels did not produce much outstanding material. Ferguson showed us where he had opened up some cavities in the walls of certain drifts, and Over and I commenced a little dynamiting. In a week's time we had had enough of it, for the results were not good enough to warrant serious effort in an atmosphere far colder, wetter, and nastier than the very worst weather outside. We did secure several fine large groups of the small-sized epidote crystals, which were well worth having. These were typically covered with a plastic yellow mud which left the epidotes very clean and brilliant after removal and acted as a good preservative while still on. Along with the epidote there was a scattering of tiny, clear quartz crystals and larger milky scalenohedrons of calcite, giving the specimens an attractive "frosted" effect.

We found another entirely different type of epidote in one drift, with crystals of a yellowish-brown color, glassy terminations, and flattened in shape so as to be quite translucent, rarely even transparent. Loose crys-

tals were to be had in abundance, but groups were difficult to get. Constant dripping water added to the collecting difficulties. Any sort of hole dug or dynamited in the rock-wall promptly filled up, and one wasted a lot of valuable time bailing out epidote pockets with ancient tin cans or even fishing with the fingers for loose crystals in six or eight inches of clear water.

These tunnels were weird places to be in, as are all abandoned mines far below the surface, with a maze of passages and drifts twisting off in all directions, water always underfoot and overhead, and the continual, often-unearthly sound of it dripping on solid rock. Flickering candles and lamps did not penetrate very far into the surrounding eerie blackness, and one would be sometimes only a footstep away from the brink of some yawning stope. falling away from the tunnel floor into a black abyss. Over and I had an unpleasant experience in one of these old tunnels, which we are not likely soon to forget, and which I repeat for the sake of indicating that mineral collecting is not always child's play.

We had hand-drilled four holes in two likely sections of the tunnel wall, two in one place and two about fifty feet distant at the very back of the drift. Between these places the tunnel made two sharp turns. After the holes were loaded, that is, partly filled with dynamite, and the fuse with detonating cap attached buried in this and carefully tamped down with more dynamite, and the rest of the hole tightly filled with mud or wads of paper; after everything was thus all ready, we made an elaborate plan for lighting the fuses. Over would light two of them at the back of the tunnel, then signal me; and while I was lighting the others, he would have time to come out past me.

With ordinary fuse there would have been no difficulty, but the fuse which we had bought in Ketchikan had proved to be entirely undependable. In dynamiting one must obviously be able to depend on standard burning qualities of the fuse used; thus such and such a length

OUR BASE CAMP ON HETTA INLET

takes exactly so many seconds to burn through before reaching the cap at the end, and these seconds are mighty precious ones for getting away as fast and far as possible before the explosion. But nothing was right about this fuse of ours and we had no confidence in it. Sometimes it burned too quickly, or more often was very hard to light, and when it did light often went out after burning through only a few inches. All of these irregularities spell danger, for with more than one fuse to light one must allow the identical time for lighting each one of them to insure a safe get-away. To give us plenty of extra time, Over and I had cut our fuses about twice as long as usual, allowing about three minutes for each to burn through.

I remember very distinctly waiting there in the dark tunnel, watching the two candles spluttering fitfully beside me and the grotesque shadows flitting along the surrounding rocky walls; and listening intently, and hearing nothing but the drip-drip of endless drops of water; and wondering why it was taking Over so confounded long to get his two fuses lighted at the back of the drift. Suddenly there came his yell of "Fire!" and I promptly struck a match and applied it to the cut end of my first fuse. I just had it lighted as Over came stumbling around the corner with his carbide lamp, and I struck another match for the second. Over shouted, "Hurry up—one of mine's going off damn quick!" Which meant that his first fuse had been lighted quickly and his second had given him all the trouble. It meant also that we didn't have any time to lose.

All the underground devils seemed to be working against us that afternoon, for my second fuse simply refused to light. Time was getting short. Over pushed me aside and jammed the long flame of his carbide into the frayed fuse-end. It was only our knowledge of how important it was to get all our fuses lighted that kept us working feverishly over that last one so long.

All at once there was a sharp hiss and a tiny spurt of flame as the fuse started burning. At the same instant there came, without warning, the most ear-splitting volley of sound I ever hope to hear. All the ensuing seconds will be forever hazy, but I seemed to find myself thrown to the ground as by some overwhelming force as the blast of the concussion rushed past. The lights were out, powder fumes came pouring down the tunnel in a choking cloud, my senses seemed to have left me altogether. First I had a frightful sensation of stark terror and the blind thought that one of the charges had gone off right beside us; and I recall even vaguely wondering that I seemed able to struggle to my feet in the darkness. But then came a clearer and still more frightening thought, as I heard the hiss of the two lighted fuses with a few inches of my face! Then we were groping for each other in the darkness, finding our wits again as Over lighted his carbide with a blow of his palm, and running and stumbling away, down that tortuous maze of passageways, falling over loose rock and into shallow pools of water, hardly seeing our way at all in the murky blackness, and only at last stopping for breath when turn after turn of tunnel was between us and the danger behind. Only as we heard the final shots go off, much like intermittent rumbles of thunder, and as we finally saw ahead the daylight marking an outside, safer world, did we commence to breathe at all freely. We had the two sharp turns at the back of that drift to thank for our continued presence among the living; just that, and nothing more.

While Over and I had been getting our fill of underground mining, Henderson had been opening some surface pockets higher up the mountain and finding some good uralite and adularia. The uralite, a rare amphibole occurring in square-shaped crys-

tals made up of fibers and representing an alteration from pyroxene, came out in excellent groups, but the adularia, though showing large crystals, proved too brittle for successful working.

The weather had been improving all the time, and finally day after day set in warm and cloudless. The snow on the higher slopes was constantly receding, and Ferguson took us for a long climb up from the mines one morning and showed us a place where he had discovered a few good-sized epidotes. But he did not think this locality held much promise. It was a most difficult spot to find, lying far out on a precipitous grassy slope, and I doubt whether we would ever have discovered it by ourselves. Ferguson knew every foot of the country so well that he could have found his way blind-folded, and indeed his eyesight was now failing him so badly that he was almost literally doing just that. I don't know what we would done without him on this trip, and much of our success was owed to him.

We found this new locality decidedly to our taste, and soon were getting to work with pick and shovel. Loose epidote crystals of fair size and rather prismatic appearance began to show up in the muddy soil. Before long we were down to bed-rock, and greenish veinings of massive epidote stood out clearly throughout the garnetiferous matrix. Attacking the rock with gads and single-jacks, for it was friable at the surface, we uncovered a few small pockets of poorly-crystallized epidote. Then Over suddenly exposed a little hole in the solid wall beside him, gradually enlarged it so that he could get his hand, and soon his arm, through the opening, and finally commenced pulling out quantities of a sticky, very yellow mud. After some minutes he had exposed a surprisingly large cavity, which, sadly enough, seemed empty of anything but mud. All at once he let out a shout and held up a long black crystal. After this there came whole handfuls of loose epidote crystals, and as he commenced working down

START OF A TRIP TO COPPER HARBOR

into the bottom of the pocket, groups made their appearance. Some of the best were quite splendid, and when the pocket had been exhausted we could look at the assemblage of specimens laid out on the grass and realize proudly that few epidotes had ever been found to equal these. The crystals were of a distinctly new type, fairly prismatic, though too stout to be as long and slender as the Untersulzbach habit, showing etching effects on some terminations. Some were doubly-terminated and rather perfect, up to two and three inches long sometimes, and nearly all seemed to be untwinned, with just a few exhibiting twinning striations on the b-face. The largest groups measured up to 20 by 12 inches and were strikingly beautiful with their dense groupings of brilliant-black crystals. Quartz was practically absent, except for a few intergrown crystals here and there, as were also other associated minerals, aside from the garnet country-rock and the mud itself which showed in it frequent mattings of hair-like fibers and indicated a break-down from some original mineral like actinolite. We carried many back breaking loads of these fine groups down the steep trail to our base camp, but never minded a particle of the weight. Every extra pound meant so much more success, and we had not even touched Green Monster Mountain as yet.

It was high time that we tackled Green Monster Mountain, Ferg told us, with one eye cocked at the weather. We had already had a week of exceptional weather, and it might break at any moment. Ferg had been using his spare time building a knock-down, flat-bottomed boat, for use on the first of the three lakes which blocked our route back into the Green Monster country. He was an excellent carpenter, and despite his failing eyesight made a fine job of it. As soon as it was complete, he took it apart again, and distributed it among us in equal loads.

Viv Walters, the watchman, played an essential role in our Green Monster campaign, for we had a five-mile trip down the inlet to Copper Harbor before we could start up the old trail from there, and Viv would give us a quick, easy ride in his motorboat. He also agreed to help us cut out the trail back into the interior.

The weather stayed clear and cloudless, and one fine morning found us sweating up the trail from Copper Harbor. This trail was in bad shape, and even after hacking a way through the worst of the undergrowth, we had innumerable fallen trees to wriggle under or climb over as best we could. This was not so easy when you were carrying part of a heavy rowboat on your back. But we made the first lake without undue difficulty, where we enjoyed a good rest and magnificent view, both of the glittering half-mile Lake Mellen ahead and of the south side of Copper Mountain's lofty snow-peak behind. It was here too that the deer flies began to assail us in earnest for the first time, and we were very thankful to have our head-nets with us.

Under Ferg's supervision our rowboat was put together in short order. It needed considerable caulking, and refused to float at all to begin with, but after some use it became adequate for our purpose. Even so, one man had to keep up a continuous bailing, and it was always more or less of a race against time to see if we could keep afloat before reaching the other side of the lake.

The second lake proved to be a much smaller body of water, and we were able to cut a trail around its shore. The undergrowth everywhere was almost unbelievable in thickness, a regular network of thorny plants, vines, and bushes. Cutting a trail around Lake Mellen would have been practically impossible, for in addition to nearly a mile of impenetrable undergrowth there were steep cliffs which came right down to the water's edge.

Midway between the second lake and Summit Lake, the final one of

the three, Ferg showed us a place which he fondly called the "cliff-house." It was nothing but a rocky shelf under overhanging cliffs, but Ferg maintained that it was a grand spot for a camp and would stay dry in any sort of weather. We were a trifle dubious about the latter, but decided to go ahead and establish our advance camp here anyway. After several trips in from Copper Harbor we had it well stocked with provisions and ready for use.

Green Monster Mountain, a symmetrical, rounded 3,000-foot peak, rose directly above the far north side of Summit Lake. We only had to cross one end of the lake to be on the slopes of the mountain. Ferg insisted that another boat must be built for Summit Lake, but carrying one heavy boat up into that impassable country had been enough for us. We decided that it would be possible to blaze a trail around the end of the lake, although it meant negotiating some high cliffs on the way. But it was evident that Ferg had had his heart set on using a second boat here (in the old days he had kept three boats on all the lakes and had become much attached to that means of travel), and we thought of a compromise. Henderson had brought with him a large rubber air-mattress to help make his Alaskan nights more comfortable, and we were able to convert this into a very uncertain raft. On the first day after settling in the cliffhouse, when Ferg was ready to lead us to his old locality on Green Monster Mountain, we put this strange craft to use. Ferg frankly did not like the looks of it, so that Henderson, who was the sailor of the party, accompanied him. Just halfway around the steepest cliffs, their craft began to ship water on all sides when Ferg grew nervous and a bit shaky at the knees. Henderson saved the day by having to clamber off on the cliffs and finishing the journey by a delicate piece of rock-climbing, while Ferg made the further shore

OUR NEW BOAT ON LAKE MELLEN.
•HENDERSON AT THE OARS

safely, if a bit unsteadily. I may say that this experience seemed to cure Ferg of any desire to cross Summit Lake again, for he used our new trail to get back to camp.

This first day on the Green Monster was a momentous one for us. With Ferg's aid, we found the spot which had produced the original epidotes, a little horizontal bench perched precariously high up among the steepest summit slopes of the mountain. The grass was wet and slippery, and it was not an easy matter to climb up there. We found much evidence of Ferg's former collecting, and it was evident that he had done a lot more work than we had supposed. Fragments of epidote crystals were lying scattered about through the thin surface soil, and we opened immediate operations.

In the days that followed we stripped the bench bare of its soil covering and worked down into the solid rock. Greenish seams of epidote were prospected thoroughly and now and then led to pockety openings either lined with crystals or containing crystals loose in the mud infilling. These were invariably of the stout tabular twinned habit, some reaching a great size. But groups never came out very whole, even after the most delicate chiselling. It was obvious that only because Ferg's original specimens had been weathered out of the rock gradually over a great period of time had they remained intact and kept their size. Nature is always a far better miner than man.

Although we explored very thoroughly all the surrounding slopes, very little epidote or any other crystallized minerals were to be found. We did discover one surface pocket close to the summit which produced some large rough epidote crystals and an amazing quantity of quartz twins. These twins are a great rarity, and in all other collecting we secured only a handful of them. Most of these came out of the mine tunnels on Copper Mountain, and were quite small and decidedly flattened in shape. But this particular pocket on Green Monster Mountain yielded several hundred of the loose twins as well as several excellent matrix specimens with the twins perched on epidote. The largest only reached a size of one to two inches across, but many possessed a beautiful perfection and often had an interesting habit of a very separated development of the two individuals rather than the flattening and merging so typical in this type of Japanese. or geniculated, quartz twin. In the National Museum collection there are now arranged a very pretty grouping of many of these little twins, all in parallel rows and identical position.

Our largest epidote crystal of all was found loose on the surface in two separate pieces. Over found one part, and then later on, the other half, a hundred yards or so up the slope. The two pieces fit well together, although a partial coating of tiny secondary quartz crystals on the broken surfaces keeps them from fitting closely. The measurements of this crystal were about 5 by 3 by 1½ inches, with a weight of several pounds; it is now in the Harvard Museum Collection. Henderson, in opening up some of the largest pockets on Green Monster Mountain, took out several loose crystals nearly as large, up to three and four inches in two directions.

We made altogether five or six trips into the Green Monster, staying from three to five days at a time. We would set a time and day for the watchman to meet us at Copper Harbor with the motorboat, and I must compliment Viv in saying that he never failed us. Unfortunately, the weather became very bad during the later trips, and some of the most miserable days I have ever experienced were spent in the cliffhouse, huddled over a feeble fire with the rain pouring down outside in a regular sheet. And contrary to Ferg's opinion, that cliffhouse was not always dry! We had had an amazing dry spell, really

a record for that country, with eighteen days of rainless weather. But when that long dry spell finally broke, we knew we were in for it, and after that had rain for three-quarters of the time. It was quite impossible to do any work at all in the rain, for it generally came down in a flood and turned the whole region into a river.

Even during the finest weather we never seemed free of some sort of trouble or other. The better the weather, the hungrier we found the deerflies, and some days we found them nearly unbearable. Even the head-nets failed us. The bite of this deer-fly is extremely painful, and the resultant swelling lasts several days. But at night we had another kind of fly just as bad, an almost microscopic gnat called by the local Indians the "no-see-um." On warm nights they could be as unbearable as the deer-flies, and despite their size were capable of just as painful a bite. We had to wear our nets while sleeping, but at times they seemed able to come right through the fine mesh.

Mosquitos were not so numerous, and it is probable that the wet climate is too much for them. Bear were as numerous as any wild-life, and particularly back in the Green Monster country we ran into them continuously. They were tremendous big black fellows, and they always minded their own business. Of fish, clams, berries, etc., we had all that we could eat, and it would be quite possible for one to live off the country entirely.

Finally we had the work on Green Monster Mountain finished to our satisfaction. We seemed to have completely exhausted all of the very limited epidote occurrences, and very thorough exploration of all the surrounding country proved fruitless. The locality on the bench gave out entirely after we had gone down

HENDERSON'S "DIGGINGS" ON GREEN MONSTER MOUNTAIN

some distance into the solid rock, the epidote seams gradually disappearing into nothing but barren garnet. This latter became so hard that repeated blasting failed to have much effect on it. We were well satisfied with the results of our collecting here, and had carried many hundreds of pounds of fine specimens down the difficult trail to Copper Harbor.

About this time, well into August, the weather turned so bad that we had to spend week on end in base camp, unable to do anything but watch the rain come down. We had had all through the summer some sort of contact with the outside world by intermittent trips to the nearest Indian village twenty-five miles to the norh, and Viv's boat had proved very useful in getting us some long-delayed mail now and then, and even fresh food supplies from the mainland. Henderson was now able to arrange for a Coast Guard boat to come over from Ketchikan and pick us up. We had nearly a ton of packed mineral specimens by this time, thirty-four large boxes.

At the very last the weather cleared again for several days, and we were able to finish our prospecting of the upper slopes of Copper Mountain. Now that the snow was mostly gone, we climbed clear to the summit and had a most superb view over the surrounding country. Range after range of jagged mountains in every direction, and always the impenetrable covering of dense green forest. It made one realize more than anything else the complete inaccessibility of the region. Except for a few Indian villages scattered here and there along the inlets, and several small salmon cannaries, this island still remains just as unexplored and untouched as it was before the time of man. Who knows what may lie beneath the forests and behind all the mountains? No one may ever know.

THE BRONTOSAURUS

Brontosaurus, one of the largest animals that ever lived, exceeded in size only by one or two other dinosaurs of prehistoric times and the biggest of modern whales, has in recent years been a popular figure among artists, being frequently depicted in various kinds of advertisements and in cartoons. But it has suffered greatly from misrepresentation, as the advertising pictures and cartoons more often than not show it in association with a prehistoric man. This, according to paleontologists, is an impossible situation, since the last of the brontosaurs died approximately one hundred and thirty million years ago, whereas scientists are agreed that the earliest and most primitive prehistoric man did not appear on earth more than about a mere one million years ago.

At Field Museum of Natural History the brontosaurs are represented by an original skeleton, unfortunately incomplete, and by a large mural painting showing an entire animal as scientific research indicates it must have appeared in life. The painting, 25 by 9 feet in dimensions, is by Charles R. Knight, well-known artist who has specialized in restorations of extinct animals. The partial skeleton, which lacks the head and a large portion of the tail, is thirty-two feet long, indicating a probable total length for the animal in life of 65 to 70 feet. The largest individual brontosaurs, according to Elmer S. Riggs, curator of paleontology, who led the expedition that excavated the museum's specimen in Colorado, were about eighty feet in length, fifteen feet tall at the shoulders, and weighed about forty tons.

Despite their terrifying appearance, brontosaurs were undoubtedly unaggressive animals living rather placid lives. Their blunt teeth indicate that they fed almost exclusively upon leaves and water plants. They were comparatively defenseless against contemporaneous flesh-eating monsters, and this was probably one of the causes of their extermination. They had very small heads in comparison to their huge bodies. They were extremely mobile forward and rearward, due to the long snakelike neck and the extremely long tail terminating in an extremity resembling a whiplash, both of which gave them a long range of action while standing still so far as their legs and feet were concerned.

SOME MINERALS OF ISHPEMING, MICH.

By A. JOSEPH ALESSI, Secretary, Amateur Geologists Association, Chicago

The Lake Superior Region includes parts of Wisconsin, Michigan, Minnesota and Ontario, and has an approximate area of 181,000 square miles. The iron ore of this region occurs in scattered deposits called ranges. Oldest of these ranges is the Marquette, extending westward from the city of Marquette on the lake shore, covering about 330 square miles. The cities of Ishpeming and Negaunee, two important mining centers of the Marquette district, are situated on this range.

Iron ore was discovered here in 1844. The first iron made in the Lake Superior Region was at the Jackson Forge, located three miles east of Negaunee. Ore used was from the Jackson Mine in Negaunee, the first mine operated on this range. A monument erected by the Cleveland-Cliffs Iron Company now marks the location of the forge, ruins of which may still be seen.

Most of the iron mines of the Marquette district are operated underground, with the exception of a few open pit mines. Ores mined are both soft and hard hematite, soft earthy hematite, and limonite. The soft hematite is generally found with ferfuginous chert or "soft-ore jasper." It is this specular hematite, when mixed with concrete, that gives a sparkling appearance to sidewalks. Limonite, also an important iron-ore, is found in the Marquette district in large quantities.

The minerals the writer found at Ishpeming in association with iron-ore were: Magnetite, siderite, soapstone called "paint rocg" by the miners, calcite, aragonite, pyrite, red jasper, amethyst quartz, and milky quartz. Some of the limonite and hematite ores are porous and the cavities are lined with hexagonal and rhombohedral crystals of calcite. Jasper is found in folded bands or veins between the hematite. Magnetite occurs alone and in crystals imbedded in hematite. A specimen of amethyst quartz on hard-ore jasper, which came from a depth of 1,000 feet, was obtained by the writer. Soapstone is the rock in immediate contact with the ore and underlying this is a rock called greenstone. Iron ores are found in various forms and because of their physical appearances the following names have been applied: slaty hematite, kidney ore, grape ore, pencil ore, and rainbow ore.

Recently the writer visited various mines in the vicinity of Ishpeming and was much impressed by the tall concrete shaft houses at the Cliffs Shaft Mine, operated by the Cleveland-Cliffs Iron Company. These shafts were originally timbered, but in 1919 were faced with concrete. The ore mined here is a hard specular hematite that requires crushing. A crusher is situated midway between the two shafts which are connected with the crusher by means of steel trestles over which thee ore is carried in selfdumping cars operated by an lectrically driven endless cable.

The method of mining is known as the "room and pillar" system, much used in coal mines. The Cliffs Shaft Mine began operating in 1878, the "A" Shaft was sunk in 1880 and the "B" Shaft in 1881. Excepting the years from 18893 to 1897, this mine has been in continuous operation. These concrete shaft houses may be seen near U. S. Highway 41, which traverses the heart of the mining country.

Ishpeming, population approximately 9,000, is in the central part of Marquette County, which county is in the northwestern part of Michigan, bordering Lake Superior.

CHALCANTHITE AT BINGHAM CANYON, UTAH

By C. I. RORDELL

Salt Lake City, Utah

Chalcanthite as a mineral specimen is about as poor a mineral as I know. It is soluble in water, oxidizes very easily and unless protected by clear lacquer it often deteriorates and becomes useless as a specimen. Few minerals, however, add so much beauty to a collection as does a brilliant blue chalcanthite. If a collector, therefore, will take the trouble to protect his lovely copper specimen by coating it with clear lacquer he can well be proud of his new acquisition. A collection, however, should have two or three pieces and of different sizes of chalcanthite in order to show the mineral to its best advantage. A good example of chalcanthite as a beautifier can be seen by those who may visit the Utah Copper Company's open pit mine at Bingham Canyon and stop at the Whistle House to see Whistle Joe's collection. True the collection contains only a few specimens—pyrite, calcite, galena, cerussite, quartz — but the liberal garnishment of chalcanthite makes it a collection of rare beauty.

Chalcanthite is copper sulphate and is often made artificially which is called blue vitriol. But it is often very common in many copper mines where it is chiefly found either encrusting various minerals or else suspended from the roofs of old workings in the form of stalactites.

At Bingham Canyon, chalcanthite occurs in old workings on both sides of the canyon. Large masses had accumulated in the old stopes on the west side of the canyon most of which were dug out about 1926. Some large pieces were thus uncovered but it was before my arrival in the district. Old time Bankmen tell me there will be more of these large masses to show up so I am living in hopes of getting a few specimens.

The ore body of the deposit is now excavated by huge electric shovels and as the overburden is removed and the old workings exposed (the mine was formerly worked underground), chalcanthite can be seen in the form of a bloom. The color of the bloom is sky-blue and can easily be seen from the Whistle House.

Before the overburden was stripped, water percolated through the ground, picking up sulphuric acid from the oxidation of the iron pyrite which is very common and attacking some of the copper minerals in the weathered monzonite porphyry. In time the water also contains copper sulphate and trickling through the joints, faults and slips till it reaches the old workings it precipitates the sulphate as chalcanthite in the form of stalactites (hangs down from the roof), stalagmites (projects up from the floor), or as coatings on the walls. The tragedy in collecting here is that often great blasts of dynamite are set off in close proximity to old stopes which shatters the grandest of specimens; or a four yard dipper of a shovel may push its nose into an old working completely ruining fine specimens; and if this is not enough, some of the old workings uncovered may be found caved-in.

I have been collecting chalcanthite for some time and have observed that where the air through the old stopes and workings is the driest and the fall of ground the coarsest that chalcanthite stalactites are longer and more slender than those found where the air is a little damp. It may be, however, that the length and width of a stalactite is governed more by the amount of copper sulphate that trickles through than by the amount of moisture in the air.

Where the air was decidedly damp and the caved wall rock had crumbled, chalcanthite did not form stalactites but occurred radiated. Such

specimens would be so frail that I have been able to secure but two tiny ones about the size of small chestnuts.

In one deposit, chalcanthite occurred as a filling between two old pieces of timber, four or five inches wide and as many feet long, which collapsed as soon as they were touched. This was the most wonderful specimen I have ever run across so you can imagine my disappointment in losing it, especially after I had worked many hours digging frozen ground and through old decayed frozen timber in the bitter cold of a winter. Digging for opal in the Virgin Valley is not the only place that has its drawbacks. (Apologies to Arthur Montgomery).

Further into the old stopes where the air came from deeper levels of the mine and it was very damp and warm so that it steamed and fogged when opened up, chalcanthite was granular in form and in the shape of small triangles. This too crumpled up upon being touched.

Other observations were that in places impurities mixed with the sulphate give chalcanthite a greenish cast; sometimes clear, other times milky.

I have never been lucky enough to be present when one of the old stopes laden with chalcanthite was opened up so have none of the large masses or long stalactites that are to be seen in some of the Bankmen's homes in Bingham Canyon. The longest one I ever found, about 8 inches in length, was presented to Mr. Peter Zodac, Editor of **Rocks and Minerals,** in appreciation of the many enjoyable hours that he has given me through this magazine.

OCCURRENCE OF FLUORESCENT SEMI-OPAL AND MOSS OPAL IN VIRGIN VALLEY, NEVADA

By MARK FOSTER

As much has been written in **Rocks and Minerals** about the Virgin Valley of Nevada, it may seem superfluous to try to add more. Yet volumes would need to be written to give the average reader a good mental picture of this noted region. So before going further with the subject, it is necessary to try to form in your mind a mental picture as outlined below in order that you may get the proper conception of the occurrence and location of the opals named in the caption of this article.

First, let me dispel the idea that its erroneous name "Virgin Valley" may have already formed in your mind. It is not a valley at all but is a basin. Furthermore, it cannot be approached from any point except by **coming down into it.**

The basin has a very irregular, jagged shape and its bottom or floor has a gently sloping descent to the northeast. The floor of this basin lies at a depth of from 700 to 1200 feet below its rim and the surrounding plateau. The highest point is its southwest rim; its lowest the northeast rim. From its rim promontories reach out into the basin from every direction. Some of these promontories terminate very abruptly with steep ends. Others just gradually taper down from the top of the rim to a feather edge at the floor of the basin and become dunes and ridges of bentonite clay.

The surfaces of the surrounding rim and the highest points of the promontories are capped with a lava flow while the sides of the rim and of the promontories are covered with loose lava boulders from the above. Furthermore, the surface at top is well sprinkled with obsidian in pebble form.

Within the basin are three narrow valleys, worthy of being called valleys, running between the promontories. One heads in the northwestern part of the basin and is known as Thousand Creeks Valley. Another heads towards the southwestern part and is known as Sage Hen Canyon. The third heads midway between the two and is known as Virgin Valley. Sage Hen Canyon is the longest of the three valleys so that the greatest floor measurement of the basin is from southwest to northeast.

There is in the basin floor 64 square miles of area according to plats of the old Miller and Lux Cattle Company's holdings. The northeast rim of the basin is different from the rest of the rim as it is not a plateau but a ridge over which the road out to Denio, Oregon, and Winnemucca, Nevada, passes. Springs, both hot and cold, break out at the foot of the rim in several places, the waters joining into one little rivulet known as Thousand Creeks which finds its way out of the basin through a narrow, deep aperture or fault in the northeast corner and empties into Continental Lake near Denio, Oregon.

The walls and hillsides of the basin show distinctly to be both of marine and volcanic formation. As we ascend from the floor of the basin we start out from "sea mud" (bentonite clay) in which fossils of animal life are found; also cones and wood. Then layers of sand rock (the sand rock is a breccia of coarse obsidian grains and altered pumice) occur. Between the layers of this volcanic sand rock is either the hardened sea mud or it may show a layer of diatomaceous earth instead and so it is, from floor to rim, and alternates from hard, dried sea mud to volcanic ash and is cap-

ped with lava. Most of the opal, it is a wood replacement, is found in the sea mud layers; the common opal, jasperized opal, and semi-opal occur in the diatomaceous earth strata.

The semi-opal and moss opal veins which the writer is working were discovered in outcroppings running longitudinally with a promontory just a short distance southeast from the Virgin Ranch in Virgin Valley. The writer is sure that readers will receive a pleasant surprise when they learn who discovered the pale green, waxy, semi-opal which has a lovely greenish fluorescence. It was discovered by Messrs. Arthur Montgomery and Robert C. Vance. To new readers who may not know these two gentlemen, the writer will say that Mr. Montgomery spent much time, money and hard work in trying to develop opal mines in this section in 1934 and who wrote a most interesting article on his experiences in the October, 1934, issue of **Rocks and minerals.** (See "Digging for Opals in Virgin Valley" by Arthur Montgomery, pp. 141-145). Mr. Vance is head

of the Department of Mineralogy, Ward's Natural Science Est., Inc., Rochester, N. Y. (the world's largest mineral dealers). They are both too well-known to the collecting fraternity to need further introduction. Both gentlemen are loved and kindly remembered by residents here and occasionally they are referred to as "Montgomery, Ward & Co."

Mr. Montgomery had told Mr. Dan Archavaleta of the Virgin Ranch of the discovery of semi-opal and advised him to locate the ledge. This Mr. Archavaleta did and has since then shipped many hundreds of pounds of this fine material which eventually reached thousands of collectors.

The ledge had been discovered by Messrs. Montgomery and Vance at what was then supposed to be its north end; later exploration has shown that the ledge extended some 600 feet further to the north of the point of discovery. The ledge outcrops near the top of the promontory on the west side and as you follow the ledge south, longitudinally, it pitches south gaining depth at an angle of about 12½ degrees. It was discovered at its narrowest point which was also its shallowest depth. The ledge increases in width and thickness as it goes under ground; at present working it is 3 feet thick, width not yet determined.

The ledge in general is a mixture of common opal, jasper, opaque white common opal, translucent gray common opal, and streaks of an apple green fluorescent semi-opal for which the mine is worked. Tons of otherwise lovely specimen stuff are wasted to get the "cream," the translucent green highly fluorescent material.

Now comes the story of the moss opal. The sides of the promontories have ravines running down their sides. In October, 1936, Mr. Ralph D. Watson of Trail, Oregon, was here collecting specimens. While exploring a ravine between the ridge which carries the semi-opal and the ridge west, he discovered an extension of the semi-opal and decided to locate it. Mr. Archavaleta went with him to help establish the corners and while the two were out together Mr. Watson found "float" of moss opal on his newly staked claim Later Mr. Archavaleta was exploring above and found an outcrop of the moss opal 1 foot thick and 8 feet wide; so he located on extension to Mr. Watson's claim and modestly concedes the discovery of the moss opal to Mr. Watson.

The moss opal is broken up into what would be nice specimen sizes were it not heavily coated with a dirty crust of diatomaceous earth. This necessitates chipping away a portion of each specimen to see what is inside and about 90% of the material is discarded for lack of moss or interesting markings. Specimens have been sent by the writer to the California Division of Mines at San Francisco, and Mr. W. W. Bradley, State Mineralogist, in reporting on it writes: "These specimens proved to be more interesting than we anticipated. Under the ultra violet light they become a rich and brilliant green, and the fluorescent effect is the most vivid and striking of any we have yet seen." He was also good enough to send the writer a lovely cabachon cut from it.

Mr. Wilfred C. Eyles of the California Division of Mines, accompanied by Messrs. John Melhase and Harold Soper, recently examined the deposit.

An interesting feature of the above two described ledges is that while they are parallel to each other they pitch in different directions. The green semi-opal outcrops at the north end and gains depth as followed south while the moss opal outcrops at the south end and gains depth as followed north (longitudinally).

SHORTHAND EXPRESSION OF MINERAL PROPERTIES

By EUGENE W. BLANK

There are many and varied methods of arranging a mineral collection to obtain the maximum in systematic order. Usually the specimens are assigned a number as they are received and subsequently catalogued in a book or on file cards together with such pertinent data regarding them as the locality in which collected, size, composition; cost, if purchased, etc. It is not necessary that the numbers be assigned consecutively since a cross index file arranged alphabetically is usually provided and is more conveniently used.

For study collections the specimen number can be arranged to convey definite information in regard to the specimen. Use CGHS as a memonic in which the letters refer in their respective order to the color, gravity, hardness and crystal system.

The color of the specimen is taken as that nearest to one of nine colors listed as follows:

1. Colorless-transparent.
2. White.
3. Yellow.
4. Brown.
5. Red.
6. Green.
7. Blue.
8. Purple.
9. Black.

It will be helpful in using this system to remember that the colors deepen as the numbers increase from 1 to 9.

The specific gravity abbreviated to gravity for purposes of the mnemonic) is taken as the nearest whole number in the event the gravity is a fractional quantity. The hardness is taken as 1 to 10 according to Mohs's scale and the crystal system as 1 to 7 listed as follows:

1. Triclinic.
2. Monoclinic.
3. Rhombic.
4. Tetragonal.
5. Trigonal.
6. Hexagonal.
7. Cubic.

If desired the mnemonic may be increased to include luster, streak, etc., provided the properties involved are listed and numbered and used in logical order. Too large a number, however, becomes cumbersome and defeats the objective which is to list the salient characteristics of the mineral in as compact a form as possible.

The following table lists a few common minerals, their color, gravity, hardness and crystal system and shows in each case how the four physical properties just mentioned can be expressed by a number assigned to the mineral in accordance with the above system.

If more than one specimen of a particular variety of mineral is collected its number can be differentiated from the others by adding a small letter, i. e. 7442a. By increasing the size of the number the chance that two varieties of mineral will have an identical number is of course greatly lessened.

Mineral	Color	Gravity	Hardness	Crystal System	Mineral Number
Rutile	Brown	5	6	Tetragonal	4564
Wolframite	Brown	7	5	Monoclinic	4752
Zincite	Red	5	4	Hexagonal	5546
Azurite	Blue	4	4	Monoclinic	7442
Galena	Black	7	3	Cubic	9737

THE AMATEUR LAPIDARY

Conducted by ARTHUR KNAPP
1401 Arch St., Philadelphia, Pa.

Amateur and professional lapidaries are cordially invited to submit contributions and so make this department of interest to all.

GETTING STARTED

The fan mail to this department, since the writer took charge, has been confined to one subject, namely the initial cost of lapidary equipment. This matter has been discussed in **Rocks and Minerals** before but evidently a repetition is in order. Apparently a lot of people are thinking of taking up lapidary work but hold back because of cost.

Ten dollars ought to start any mechanic, that is, a man with no mechanical ability and no tools is going to have to pay for things which otherwise he could make. Good lapidary equipment has been made from old sewing machine and washing machine parts. Bearings can be made by pouring babbitt metal in pipe fittings. Bicycle power has been used with success when no electric power was available. All that is necessary is a shaft, about one-half inch in diameter, which may be turned at fair speed. A packing box or an old kitchen table will do for a bench, if you can't make one. Cracker tins make good splash pans. Linoleum carpet, leather or even cloth make good polishing laps. A mechanic can cast a tin lap in a frying pan and true it up on his grinding head with a chisel.

It is seldom difficult to find a small second-hand motor and in many places will be found shops selling second-hand machinery and mill supplies which may have shafts, bearings or small grinding equipment.

Supplies such as grinding wheels, loose abrasive, polishing powder and chaser cement will have to be purchased but they last a long time.

The point of this discussion is that the expense of getting started may be reduced to meet almost any pocketbook. I know that, once a man has started, he will not be satisfied with a make-shift machine, however, he will indulge in fewer movies, fishing trips or poker games and put the money thus saved into improving his equipment. So get started and see if the costs do not take care of themselves.

POLISHING COAL FOR POLARIZATION STUDIES

McCabe and Quirke
Trans. A. I. M. & M. E. 1937.

"A first polish was made on a felt-covered lap, which was kept wet with a suspension of finely ground alumina. Final polishing was completed, dry, on a small lap covered with Selvyt cloth.

ON THE AVENUE

Not long ago I saw a turquoise necklace, made of graded sizes of beads, which was quite effective and unique. The beads were in the form of nodules, the matrix having been cut away entirely. The general shape of these nodules would remind one of water-worn gold nuggets. The sizes ranged from less than one-quarter of an inch to over three-quarters of an inch. They were strung with a sep-

aration of three small dark glass beads.

If the amateur lapidary is to be up-to-date, he should try some of the latest work. The shops in New York are full of elephants, dogs and other animals cut from rose quartz, onyx, jasper, obsidian and many other materials. There are also beautiful rings cut from one piece of clear quartz. There are bracelets made with oblong links of clear quartz, connected by metal links and watches in beautifully designed clear quartz settings. Of course such things have been made before but they appear to be very popular just now.

ARTHUR KNAPP.

HOW MANY COLLECTORS?

By BILL McCAMPBELL, Calexico, Calif.

Quite often the question has been asked me: "How many of these crazy people (referring to mineral and gem collectors) are there running loose?"

I have heard the same question put to other dealers and collectors. It is also one of the first asked by people who are making their first contact with the world of collecting.

It is a difficult question to answer with any accuracy because there are no figures available, compiled for this purpose. As a matter of interest to newly converted collectors, it surpasses all others, and were it possible to answer with some accuracy it would make for wider "selling" of the hobby, the science of mineralogy and allied subjects.

Estimates of the number of collectors cannot be reconciled. A city of one million in one locality may boast of 1,500 registered collectors while a city three times larger, in some other section of the country, may muster only 1,000 collectors. An estimate based upon such figures would leave much to be desired.

For example, during fifteen years of gemstone sales and advertising, the past three years of which have included, also, sales contacts for minerals, I have contacted thousands of people each year. But my experience, being mostly with gems, has been with a heavy percentage of people who were not collectors, nor interested in collecting, except for social or commercial reasons. Therefore, in making estimates of the number of collectors there are, my tendency is to overestimate gem collectors' ranks. Not every buyer of a gemstone is a gem collector. More often it is some husband with a goading conscience, or the "boy friends" of some girl in a rare mood of generosity.

Mineral buyers are easier to classify. Generally, except during holidays, the buyer of an assortment of mineral specimens is one of the varying shades of this species.

So, from my own experience, I should estimate that we have in the United States about 6,000 new mineral-and-gem collectors who join the ranks each year and about 4,000 who come to light after having been interested for a year or two. This would make 10,000 active collectors which I consider to be a fair estimate based upon my own experience. By active, I mean COLLECTORS.

We have instances of there being as many as 75,000 people in the United States who would take some interest in mineralogy and allied subjects, at one time. These people were not, however, necessarily all collectors or even interested in mineralogy beyond the moment. We have about 4,000 collectors registered in various ways. These registered collectors include both new and old and active and inactive.

Not all new-comers to the fraternity remain interested. The mortality is higher than it should be owing to our lack of facilities for keeping them interested. Old collectors pass away, or retire from active collecting for various reasons.

The current registrations, for example, lose about 2% per month from the lists, due to death, loss of interest, new interests, or financial reasons of one kind or another.

With so many factors to consider, it is apparent that an estimate of the number of active collectors can be only from an individual viewpoint and cannot be accurate in a practical sense.

Therefore, I feel that it would be a matter of great interest to everyone concerned to have as many experienced collectors and others interested in minerals make an estimate of the

number of active collectors in their state. Compilation of these estimates should give everyone a clear idea of the rapid growth being made in the field of mineral collecting.

I would suggest that these estimates be made by secretaries of mineral clubs and dealers in minerals, supplies, and equipment for mineral collectors as well as the estimates made by collectors themselves.

Everyone whose interests lie in the advancement of mineral-collecting should find such a survey of the field of great interest and value. It would give us all good ammunition for propaganda among the unconverted. It should at least put the matter on a fair basis for controversy among estimators.

Naturally, I do not expect anyone to agree with me on my own estimates; and I reserve the right to disagree with everyone who make an estimate, even if they agree with me.

For sheer diversity of opinion I can conceive of nothing that would create more furore among collectors than such estimates. As a preliminary survey, I asked ten dealers, curators, and establishments for such estimates. Just try to get an agreement from these figures:

(NOTE: I asked these people this question: "How many active mineral collectors and gem collectors do you estimate there are in the United States and Canada?").

Dealer No. 1	5,000,000
Dealer No. 2	20,000
Dealer No. 3	1,000,000
Dealer No. 4	1,000,000
Collector	100,000
Curator	2,000,000
Dealer No. 5	5,000
Dealer No. 6	10,000
Dealer No. 7	10,000
Dealer No. 7	15,000
Collector-teacher	48,000

Which would you say was most accurate?

Editor's Note:—Those who feel they are competent to place an estimate upon the number of collectors in the country are requested to submit their figures direct to Mr. McCampbell.

CHALCEDONY AND AGATE AFTER PREHNITE

By WM. C. CASPERSON

Many specimens of agate and chalcedony showing orbicular designs in its structure have been found at Braen's Quarry in Hawthorne, N. J. These orbicular designs or balls range from tiny microscopic to those of about one-quarter of an inch in diameter. When broken or cut in two they show a distinct radiation in structure and when specimens are polished they are quite attractive.

For some time I have studied this formation in trying to determine the meaning of these radiating designs. On April 5th, last, I found a specimen which solved the mystery. This specimen comprises a veritable mass of these balls of agate from one-eighth to one-quarter of an inch diameter.

Upon examination I found that the surface of the balls presented an exact reproduction in form of the surface of prehnite balls that are characteristic of this quarry. They are a very accurate substitution of chalcedony and agate for the original mineral, prehnite, and are, therefore, pseudomorphic.

In almost every instance the radiating structure of the prehnite is accurately reproduced and in this particular specimen referred to, the prehnite termination as well.

The surfaces of the agate casts are coated with a white substance which appears to be a silicate, possibly kaolin. Tiny black dendrites appear on the white kaolin which very probably are manganese as the quarry is noted for its occurrence.

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